DOCUMENT RESUME

ED 034 270 CG 004 747

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TITLE Individual Differences in the Consideration of Information Among Two Year Old Children.<
INSTITUTION Harvard Univ., Cambridge, Mass.; National Inst. of Mental Health (DHEW), Bethesda, Md.; Yale Univ., New Haven, Conn.
PUB DATE 69
NOTE 16p.

EDRS PRICE EDRS Price MF-$0.25 HC-$0.90
DESCRIPTORS *Behavior Patterns, *Childhood Interests, Children, Games, *Individual Differences, *Response Mode, *Toys

ABSTRACT

One central aspect of children's behavior in play and in situations of response uncertainty may involve the degree to which the child considers available information and forms a plan to guide behavior. Twenty-five boys and 25 girls, aged 27 months, were observed in a 30-minute free play session in which mobility and time spent in sustained involvement with toys were coded. In addition, the response times on an embedded figures task and on a two-choice discrimination task which induced conflict were obtained. Sustained involvement with toys was positively related to response times in conflict situations and negatively related to motor activity. (Author)

ED034270

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INDIVIDUAL DIFFERENCES IN THE CONSIDERATION OF INFORMATION AMONG TWO YEAR OLD CHILDREN[1]

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Reflection-impulsivity refers to individual differences among school-age children in their decision time in a problem situation containing a number of simultaneously available solutions (Kagan, 1964, 1965b). Reflection is the tendency to respond slowly and consider the alternatives; while impulsivity is the tendency to respond quickly without evaluating adequately the alternative hypotheses. Match to sample tests, e.g., the Matching Familiar Figures (MFF) and the Haptic Visual Matching Test (HVM), typically have been used to assess reflection-impulsivity (Kagan, 1965a,b,c). In these tests, the child is asked to select from an array of similar stimuli the one which is identical to a standard stimulus. Decision Time is the operational measure of reflection-impulsivity. This dimension has been shown to be stable across varied tasks (Kagan, 1965b), reliable over time (Kagan, 1966), and modifiable (Kagan, Pearson & Welch, 1966).

Recently, Pedersen & Wender (1968) reported a relation between a style of play behavior at 2 1/2 years of age and test performance at 6 years that may be related to reflection-impulsivity. The behavior of 30, 2 1/2 year old boys was rated over four weeks in a nursery school situation. Four years later, each S was administered the Sigel Sorting Test and a shortened form of the WISC. Verbal ability at six years was independent of the earlier behavior ratings but children who frequently sought physical contact and attention from adults and spent little time in sustained directed activity (SDA) with toys did poorly on the performance scales of the WISC and used a relational strategy of classification on the Sigel Sorting Test. These Ss behaved as if they were impulsive (Kagan, Rosman, Day, Albert, & Phillips, 1964). In comparison, Ss who had long

periods of sustained play did well on the performance scales and used categorical sorts which is more typical of reflective children. A negative correlation between attention-seeking behavior and sustained directed activity affirmed the independence of these two groups of children. Thus, it appears that 2 1/2 year old children who display long periods of sustained involvement with toys are more likely to be reflective than those who have short epochs of play.

One central aspect of children's behavior in play and in situations of response uncertainty seems to involve the degree to which the child considers available information and forms a plan. The tendency to form a plan to guide behavior may increase sustained involvement in play and prolong response time in ambiguous situations. For example, one child in a room with toys immediately begins playing with blocks and does so for a few seconds before going to another toy; another child in the same situation looks over the toys and then plays with the blocks for 60 seconds or more. Correspondingly, in a situation of choice between alternatives, the child who played with blocks for a few seconds makes a decision almost immediately; in comparison, the long playing child makes a choice after considering the alternatives. In both situations, the fast responding child seems to act on impulse with no plan to guide his behavior; whereas the slow-responding child appears to reflect upon the available alternatives in a more thoughtful fashion before acting. This example is not meant to imply that one child has more information than another but rather that the second child considered the available information in both situations more deliberately than the first child and then made use of it.

In a study related to information processing in a conflict situation, Maher, Weisstein, & Sylva (1964) found a wide range of oscillation responses among young children when confronted with a choice between different goal objectives; some never oscillated and others did so with great frequency. The stability of the response was demonstrated in a correlation of .94 between

children's oscillations on a risk of no reward condition and those on a certainty of some reward condition. The children who oscillated the least seemed to consider the alternatives and then respond, whereas children who oscillated the most did not seem to form a plan before responding. The former may have a more reflective attitude and the latter a more impulsive one.

In another study, Scarr (1966) devised a task directly analagous to those used to assess reflection-impulsivity. Each of 61 pairs of monozygotic and dizygotic twin girls, aged 6 to 10 years, had to choose between a hidden toy which she had not seen and a second toy which she had seen and which was placed in a box identical to the one containing the hidden toy. On the variable of decision time, the identical twins demonstrated greater within-pair similarity than the fraternal twins. This finding may constitute evidence for a hereditary component in the reflection-impulsivity dimension.

Finally, there is evidence to indicate that motorically active children are more impulsive and less likely to consider information for any sustained time period. Heider (1966) found that highly active infants were often characterized by minimum delay in response as preschool children. Kagan (1965a) found that preschool children who engaged in vigorous activities were impulsive in their responses to MFF and HVM tests administered between the ages of 7 and 13 years. Shaefer & Bayley (1963) found that very active 10 month old boys were rated as low on attentiveness during the period 27-96 months of age.

The purpose of the present investigation is to demonstrate a correlation between indexes of reflection-impulsivity in tasks of uncertainty and indexes of sustained involvement in play among two year old children. We expect that these two dimensions share variance because they are both influenced by the tendency to consider available information and to form a plan to guide behavior. Moreover, a measure of motor activity is expected to be negatively

related to both sustained involvement with toys and longer decision times because motorically active children are less likely to sustain involvement and consider information.

Method

Subjects.

The Ss for this study were 50 white children, 25 boys and 25 girls, aged 27 months who were originally recruited by advertisements in one of the local newspapers as part of an extensive longitudinal study being conducted by Jerome Kagan. The children were seen as close to 27 months from their date of birth as possible within 14 days. With the exception of one child who was accompanied by her older sister (the child's chief caretaker because of the mother's paralytic condition), all children came to the laboratory with their mothers. Social class was indexed by parents' educational level[2] and children from varied educational levels were represented in the sample.

Procedure.

(1) Free Play

E escorted the mother and child into a large (21' x 15') furnished playroom. Brown masking tape on the floor divided the room into 35 equal squares, 3' x 3'. E offered the mother a seat on the end of the couch, but gave her no explicit instructions. The mother and child were left in the room alone for a 5 minute adaptation period in order to alleviate any fears which the child might have regarding this new environment. At the end of this adaptation period, E returned and arranged 10 toys (bell-boys, mallet, playdough, pixie doll, wagon, colored wooden blocks, large clear plastic box, flutterball, riding train, and toy rifle) in a standard pattern on the rug. E gave the mother two magazines and asked her not to initiate any interaction with the child, not to encourage him to act in any particular way, and not to prohibit any

activity unless she considered his safety at stake; but, within the context of these restrictions, to be as natural as possible. E then left the room and the child was allowed to play with the toys for 30 minutes.

During the 30 minute free play session the major variable coded was length of involvement in sustained directed activity (SDA) with toys. SDA was defined as a single uninterrupted behavioral involvement with toys that might include one or more act changes, e.g., ringing the bell on the train, sitting on the train, loading blocks into the train, riding the train around the room, ringing the bell and then loading blocks into the train again; would be scored as one SDA, even though there were six act changes and four different acts. Two assistants independently coded SDA on an Esterline Angus Event Recorder for all 50 children. The mean of these two recordings was used unless the difference between the coders was more than five seconds. In such cases, SDA's were corrected by listening to a tape recorded description of the session. If any questions of accuracy remained, a permanent television tape of the session was used. The initial reliability coefficients for uncorrected SDA for 20 children ranged from .72 to 1.00, with a mean reliability coefficient of .97. Since these figures seemed inflated by a very high agreement between the coders on SDA's 100 seconds in length or longer, reliability coefficients were obtained for uncorrected SDA's less than 100 seconds in length. The range was from .64 to 1.00 and the mean reliability coefficient was .88.

A record of the child's locomotor movement (the number of squares traversed) was also obtained. The mean reliability coefficient for five children was .97.

(2) Embedded Figures Task (EFT)

E presented the child with a picture of a girl and taught him to touch the figure. Next, while keeping this model within the child's view, she presented him with a series of backgrounds with the figure embedded in them. The child's

task was to find and touch the figure. Following the initial learning, E showed the child six sets of embedded figures, each consisting of a model and three embeddings of the model. The first three sets were relatively easy discrimination tasks consisting of a dog, horse, and bird in backgrounds containing a number of colored figures that looked progressively more like the model as the difficulty increased. The final three sets were schematic drawings of a cat, car and flower, embedded in black and white line backgrounds. If possible, at least one response to each embedding was obtained. Only two children refused to play at all, and only two others failed to complete at least the first four sets. Length of fixation time to the stimulus before making a response was recorded. The mean reliability coefficient for three children was .99.

(3) Conflict Situation Task (CST)

E told the child they were going to play a game with candy (M & Ms). The conflict apparatus had two cups in the front below two white plastic encasements. Each encasement contained both a red and yellow light which were invisible unless turned on. E controlled the lighting and could turn on any single light or any combination of one light on each side. Each time the child touched the yellow light first, he was rewarded with an M & M which was delivered in the cup below the correct light. Once E felt confident that the child had learned the discrimination, she used a fixed schedule for alternative stimuli, in which the most probable chance score would be 50% correct (Gellermann, 1933). After the child had five consecutively correct trials in this schedule, two red lights were presented, producing a negative conflict situation in which there was no correct answer (Neg). After receiving two more red and yellow light discrimination trials, the child was presented with two yellow lights, a positive conflict situation in which both choices were correct (Pos). Seventy percent of the children learned the task and were presented with the conflict situation. Length of fixation time before making a choice was recorded and mean reliability coefficient for three children was .99.

The hypothesis that a conflict had been induced in the child had to be demonstrated. Berlyne (1960) stated that "situations in which uncertainty is of importance are situations of conflict (p. 29)" and showed that increased reaction time in a two-choice discrimination situation is a measureable index of conflict (Berlyne, 1957, 1960, 1965). Therefore, if conflict had been successfully induced, the response time to the conflict trials should have increased over the response times to the mean of the five criterion trials and to the trials immediately preceding each conflict trial, regardless of individual differences among the children. T-tests were performed and the p values are presented in Table 1. The results clearely indicate that conflict was induced.

Insert Table 1 about here

Seven variables from the three tasks--free play, EFT, and CST--were investigated. The measures of sustained involvement in the free play were the length of the median and 75th percentile SDA's. The measures of reflection-impulsivity were the mean first response times (length of fixation time before making a response) to the dog, horse, bird (DHB) series and to the cat, car, flower (CCF) series of EFT, and the decision times (length of fixation time before making a response) to the negative and positive conflicts of CST. The measure of mobility was the number of squares traversed during the free play. The correlation matrix for these variables plus social class is presented in Table 2.

Insert Table 2 about here

The indexes of sustained involvement were correlated with a tendency toward longer decision times in the conflict situations. The relations between the decision times in the conflict situations and the length of sustained directed activity were striking. The correlations between response times to EFT, especially the CCF series, and sustained directed activity were generally in the expected

direction but were not statistically significant. Social class was positively related to the 75th percentile SDA for boys but was not related to any of the other variables for either sex. Moreover, as predicted, mobility was negatively related to the other measures.

Discussion

The establishment of a relation between long epochs of sustained involvement in play and long response times in situations of conflict among two year old children provides support for the hypothesis that a dimension involving the tendency to consider available information and to form a plan to guide behavior is operative during the third year of life. This finding, in conjunction with that of Pedersen & Wender (1968), strengthens the belief that a dimension influencing reflection-impulsivity in grade school children might be detected during the pre-school years. The lack of relation between response times to either of the EFT series and the other variables suggests that in relatively easy situations of response uncertainty the influence of the reflection-impulsivity dimension is less than in more difficult ones. The pattern of increasing correlation between response time to the CCF series and the other variables adds credence to this argument, since the CCF series were more difficult than the DHB series (the mean first response time to the DHB series for all children was 3.0 seconds; for the CCF series, it was 5.2 seconds).

We expect that the two year old children who had long decision times and long involvements with toys will be reflective on tests like MFF and HVM at five and six years of age. Observation of six of the children at three years of age revealed remarkable stability over the nine month period from 27 to 36 months. In a 20 minute free play session in which there were three toys in the playroom, three children, who spent long periods of time involved with toys at 27 months, had very long SDA's (75th percentile SDA's were 408, 565, and 1194

seconds) at 36 months; whereas three children, who had short periods of involvement at 27 months had short SDA's (75th percentile SDA's were 62, 71, and 92 seconds) nine months later. In addition, on a revised and more difficult version of EFT, the three children with long SDA's had longer response times (mean of 15 trials = 12.9 seconds) and fewer errors (mean of 15 trials = .20) than the three children with short SDA's who had shorter response times (mean = 6.2 seconds) and increased errors (mean = .53). The children with long SDA's performed in a manner similar to reflective grade school children while children with short SDA's resembled impulsive older children.

The moderate relation between social class and sustained involvement in play among boys indicates that level of cognitive development may influence the dimension, but the lack of relation between educational level and any of the other measures for either sex argues against this as the major explanation of the results. The inverse relation between mobility and both sustained involvement and decision time suggests a possible biological influence. The explanation which we favor is that a child's tendency to consider information and form a plan to guide behavior is a basic variable which is modified by the environment as the child matures. This notion implies that the tendency to consider information is not dependent upon existing cognitive structures--all children have the tools to consider information before responding but this is not the preferred mode of functioning for many of them. Flavell, Beach, & Chinsky (1966) have shown that while the five year old child has learned words for familiar objects, he may not have learned to use these words in a problem context. That is, a child may "have" a language but not "use" it. Impulsive children <u>have</u> information but do not use it as extensively as reflective children do.

If the assumption that part of the variance in the reflection-impulsivity dimension is the result of a biological predisposition, then we should be able to find antecedents of this dimension during the first year of life. We are currently in the process of analyzing data collected as early as age four months with this goal in mind.

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Footnotes

1. Based on a dissertation submitted to the faculty of the Graduate School of Harvard University in partial fulfillment of the requirements for the degree of Doctor of Philosophy. The author wishes to thank Professor Jerome Kagan, Mr. Michael Novey, and all those members of Professor Kagan's staff who contributed to this project. This research was supported in part by a pre-doctoral research fellowship MH-15, 206 OIAI from the National Institute of Mental Health and from research grant MH-8792, from NIMH, USPHS, to Jerome Kagan.

2. Social class was indexed by mean parental education level using the following metric:

6 = post college

5 = college degree

4 = part college

3 = high school diploma

2 = 9th grade completed

1 = 9th grade not completed

Table 1

t-test for Matched Decision Times

on the Conflict Situation Task

Variable	Difference between means	df	t Value
	Girls		
Neg-Pre tr[a]	2.12	16	2.88**
Pos-Pre tr[b]	0.69	15	2.06
Neg-Cri[c]	2.46	16	3.91***
Pos-Cri[d]	0.58	15	1.95
	Boys		
Neg-Pre tr	3.15	17	4.60***
Pos-Pre tr	1.04	15	2.41*
Neg-Cri	3.24	17	4.58***
Pos-Cri	1.04	16	3.29**

[a] Neg-Pre tr = Decision time to the negative conflict trial minus decision time to the immediately preceding trial.

[b] Pos-Pre tr = Decision time to the positive conflict trial minus decision time to the immediately preceding trial.

[c] Neg-Cri = Decision time to the negative conflict trial minus the mean decision time to the five criterion trials.

[d] Pos-Cri = Decision time to the positive conflict trial minus the mean decision time to the five criterion trials.

* $p < .05$, two-tailed tests.
** $p < .01$, two-tailed tests.
*** $p < .001$, two-tailed tests.

Table 2

Product Movement Correlations Between All Variables

	Girls[a]							
Variables	Social Class	Median SDA	75th percentile SDA	Response time to DHB	Response time to CCF	Decision time to negative conflict	Decision time to positive conflict	Mobility
Social Class		-.13	.06	-.06	.09	.34	.35	.18
Median SDA	.34		.68**	-.01	.33	.51**	.52**	-.39
75th percentile SDA	.50**	.78***		.09	.21	.17	.29	-.42*
Response time to DHB[b]	.23	.08	.09		.33	.02	.29	-.23
Response time to CCF[c]	.31	.31	.25	.67***		.32	.23	-.44*
Decision time to negative conflict	-.13	.35	.44*	.08	.05		.73***	-.17
Decision time to positive conflict	-.06	.38	.71***	.20	.34	.75***		-.06
Mobility	-.02	-.36	-.42*	-.24	-.38	-.29	-.48	
	Boys							

[a] Correlations for girls are in the upper triangle; correlations for boys are in the lower triangle.

[b] Mean first fixation time before response to the dog, horse, bird series of EFT.

[c] Mean first fixation time before response to the cat, car, flower series of EFT.

* $p < .10$, Two-tailed tests.
** $p < .05$, Two-tailed tests.
*** $p < .01$, Two-tailed tests.